The Internet and The Complexity of Success

Robert Pepper
Chief, Office of Plans and Policy
Federal Communications Commission
<rpepper@fcc.gov>

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Internet Trends

- High rate of growth
  - 1.2 million domain names as of 4/97, up from 30,000 in 1/94
- Flat-rated pricing ($19.95/month standard)
  - Some ISPs move away from this model (e.g. Netcom), but mass shift to metered pricing has not taken place
- Increasing numbers of ISPs
  - Over 4,000 in North America, and 31 national backbones *(Boardwatch July/August 1997 ISP Directory)*
  - Expected "shakeout" hasn't really happened yet
- Innovation in both software and hardware
  - Internet telephony
  - Web TVs
  - Push media
  - Streaming audio/video
  - Wireless services
  - Networked interactive games

Reasons for Growth

- Demand for services and bandwidth
- Technology becoming easier to use and cheaper
- Scalable architecture
- Competition decreases costs
  - software, hardware, and backbone networks
- "Unregulated"
  - BUT... longstanding government funding and active involvement in ARPANET, NSFNET, DNS and IP number assignment, NAPs
  - ALSO... FCC Computer II decision expressly safeguards enhanced services from RBOC discrimination (back then AT&T)
  - ALSO... ISPs and customers take advantage of regulated telephone rates, and leased data circuit rates that have dropped dramatically since the breakup of AT&T

The Complexity of Success

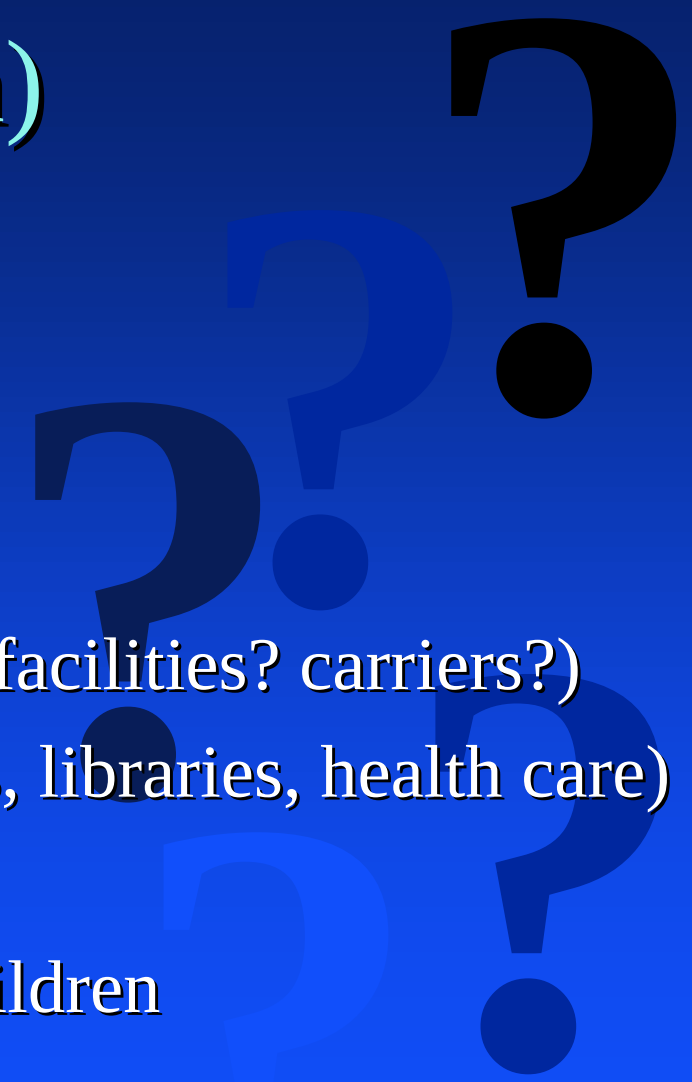
- Be careful what you ask for
- Expectations change with growth
- The (good?) old days
  - The whole industry could sit around the table of a Chinese restaurant
  - average users are engineers, academics, and scientists
  - major services are ftp, and email
- The (better?) new days
  - takes this ballroom just for one conference
  - 30 million US households, filled with 9 year olds playing online games
  - the Web, and emerging streaming audio/video

The Complexity of Success

- The new realities of the Net create questions
  - What if everyone logged on at once to play the same networked game?
  - What if the average Internet connection was in use as much as the average television set -- 8 hours per day?
- Tragedy of the Commons
  - Individual users and service providers may not have the proper incentives or resources to address collective challenges
- What this means -- the Internet is growing up

Emerging Policy Questions (Policy ≠ Regulation)

- Network congestion
- Reliability and service quality
- Governance
- Investment and innovation
- Definitional issues (services? facilities? carriers?)
- Universal access (esp. schools, libraries, health care)
- Privacy
- Inappropriate materials for children
- Electronic commerce



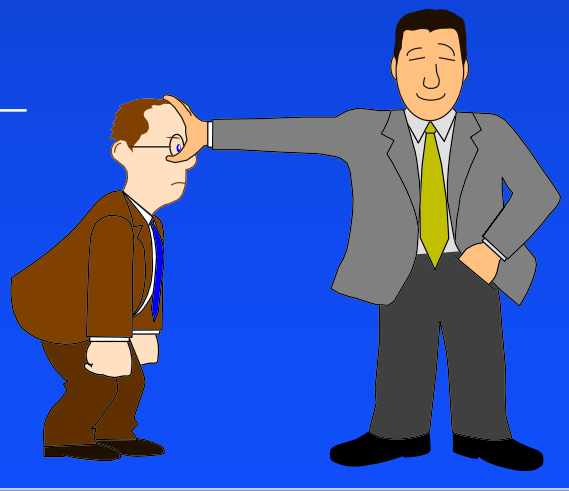
Policy Goals

- Competition
- Technological innovation
- Investment and job creation
- Affordable access
- Increasing bandwidth to businesses and the home

- Result -- continued growth of the Internet

Who is Standing in the Way?

- Government?
  - local? state? federal? foreign? international?
- Incumbent telephone companies?
- Spectrum hogs?
- State and local taxation authorities?
- Software hogs?
- ISPs? (tragedy of the commons)



Internet Myths

1. The Internet has prospered because government has not been involved

- Oh? So the FCC shouldn't have prohibited telcos from charging ISPs per-minute access charges?
- What about the 20+ years of R&D funding from DARPA and NSF?
- And isn't the government the single largest institutional user of information technology in the United States?

Internet Myths

2. The Internet is totally decentralized

- Could there be multiple authoritative roots for the Internet addressing system, so that typing in www.boardwatch.com in your browser might take you to several different sites?
- If a major backbone ISP broadcasts incorrect routing information from one of its downstream ISP customers, is there no threat to the stability of the network?

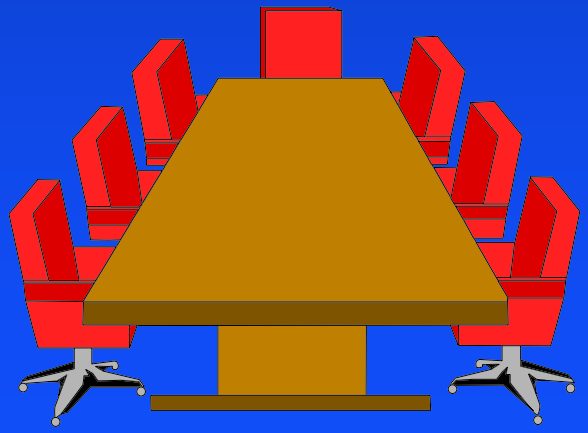
Internet Myths

3. The Internet community is comprised of "cyberlibertarians" who reject all authority

- Should there be no penalties for committing fraud on the Net?
- Should ISPs rely on the goodwill of monopoly telcos to deploy affordable high-bandwidth data networks?
- Should companies be able to do whatever they want with your personal data they obtain online?
- Do you enjoy being spammed?
- Is there nothing wrong with children accessing pornography online?
- If the major Internet backbones crashed for 3 days, would you mind?

Internet Governance

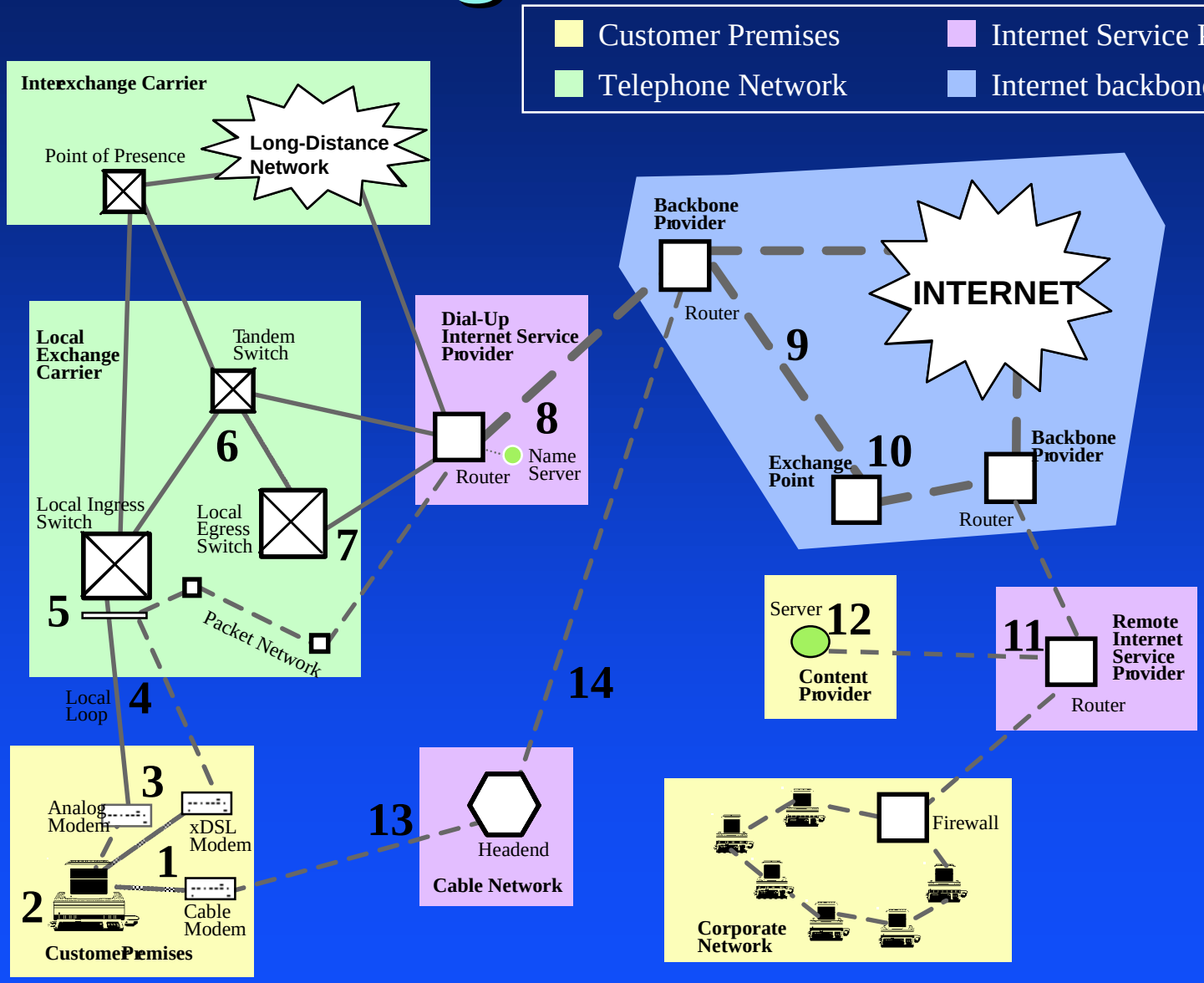
- Governance is not the same as government
  - A vacuum is a dangerous thing
  - Fools rush in
- Who governs when the Internet governs itself?
  - How do you vote? Where do you go to vote?
  - Who gets a seat at the table?
- Who is responsible when things go wrong?



Network Reliability

- Internet usage increasing rapidly
  - Represents 5-10% of total minutes on the telephone network today
  - Increasingly important for "mission critical" applications
- Need for better data about congestion effects
  - Network Reliability and Interoperability Council has traditionally addressed large-scale outages (e.g., cable cuts), not localized congestion
  - Responses to FCC Internet NOI provide some information, but more comprehensive and consistent data are required
- Solutions should be industry-driven, but industry must act and government can facilitate

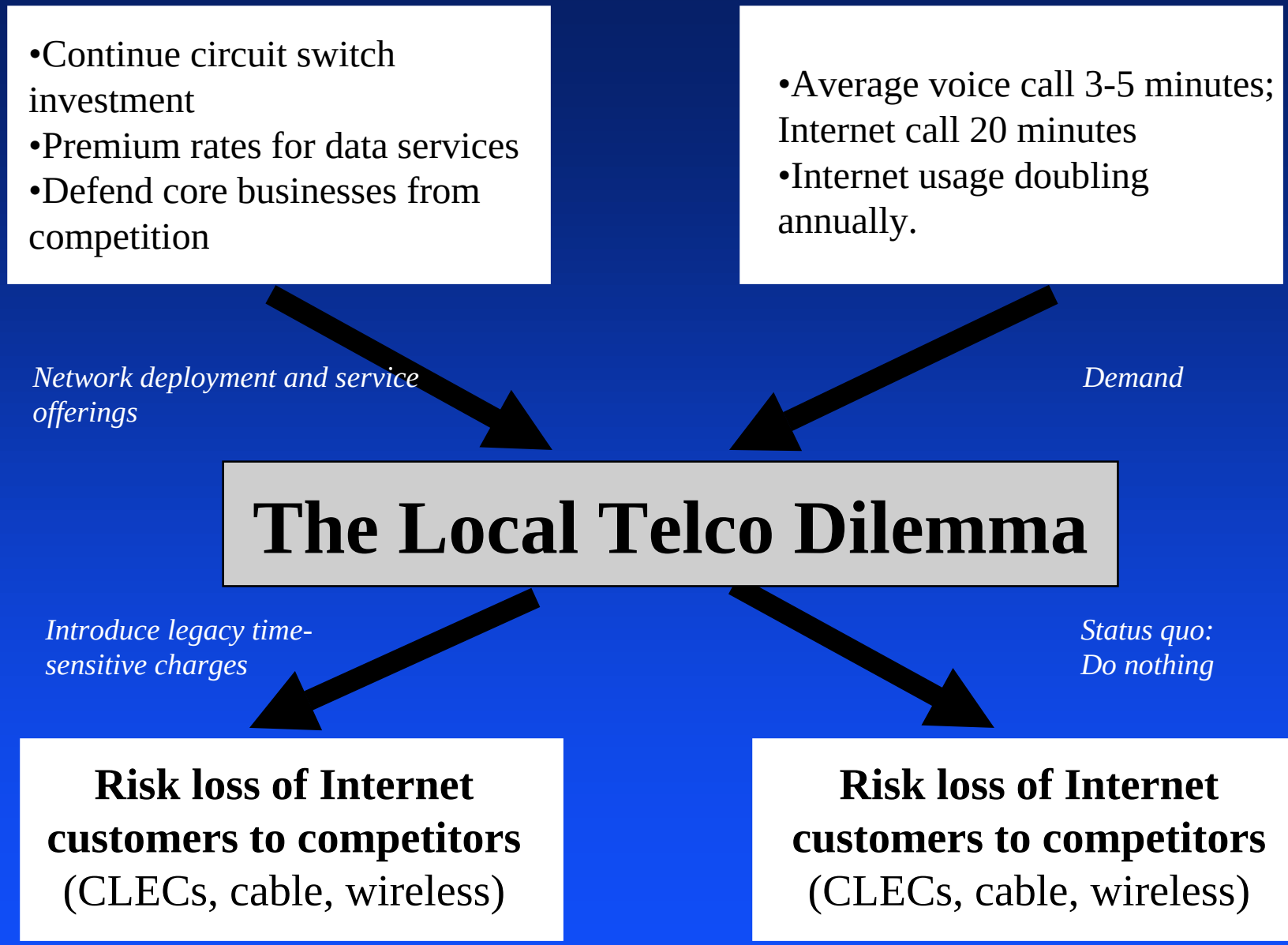
Internet Congestion Points



Congesting the Phone Network? (Packet Data in a Circuit World)

	Office Avg. Busy Hour Usage	ISP Avg. Busy Hour Usage	Office Avg. Call Hold Time	ISP Avg. Call Hold Time
Bell Atlantic	3 CCS	26-28 CCS	4-5 minutes	17.7 minutes
US West	3 CCS	27 CCS	2-4 minutes	14 minutes
Pacific Bell	4 CCS	19 CCS	3.8 minutes	20.8 minutes
SBC	4 CCS	31.4 CCS	NA	NA
CIX	NA	NA	NA	26 minutes

Sources: Usage studies submitted to FCC in 1996 and 1997 (CC Docket 96-263 and public file CCB/CPD 96-16)


•Continue circuit switch investment
•Premium rates for data services
•Defend core businesses from competition
•Average voice call 3-5 minutes; Internet call 20 minutes
•Internet usage doubling annually.
Network deployment and service offerings
Demand
The Local Telco Dilemma
Introduce legacy time-sensitive charges
Status quo: Do nothing
Risk loss of Internet customers to competitors (CLECs, cable, wireless)
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- Rising costs of expanding modem pools and lines
- Competition from many sides (LECs, IXCs, cable, wireless, other ISPs)

- Internet usage doubling annually
- Customers increasingly unsatisfied with 28kbps dial-up connections

Network deployment and service offerings

Demand

The ISP Dilemma

Use incumbent LEC data alternatives

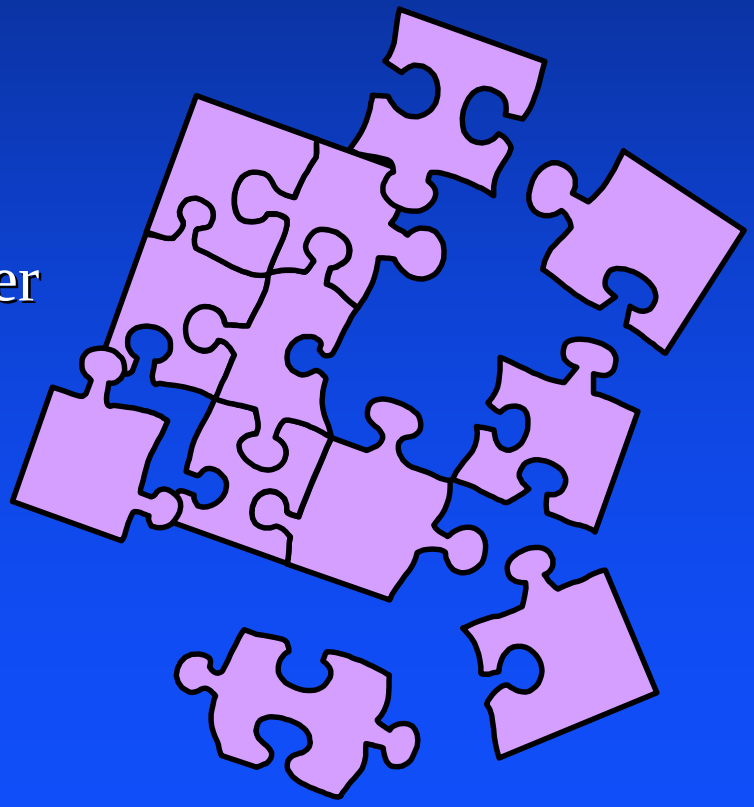
Status quo: Do nothing

Risk loss of customers to lower cost competitors

Lock in ineffcient low-bandwidth technology

The Bandwidth Puzzle

- AT&T
- MCI
- Sprint
- Worldcom
- IXC
- Qwest
- Brooks Fiber
- TCG
- TCI
- McLeod
- DirecTV
- Comcast
- Media One
- @Home



- Primestar
- Sky Station
- Teligent
- Teledesic
- Iridium
- Metricom
- Winstar
- WilTel
- Cox
- Nextel
- and many more!

Is there a Role for Government?

- Restrain dominant incumbents/promote competition
- Carve out unregulated services (insulate from regulation)
- Incentives for innovation (e.g., deployment of data-friendly networks, increased bandwidth)
- Fund research efforts
- Consider social welfare
  - consumer protection, free flow of information, affordable access
- Allow/encourage industry cooperation
- Be an informed information technology consumer

Pressure on Traditional Models

	Common Carriage	Broadcast	Internet
Information Flow	One-to-One	One-to-Many	Any-to-Any
Capacity Constraint	Interconnection	Scarce Spectrum	Statistical Multieplexing
User Role	User-initiated point-to-point communnications	Little/no user control (push)	User-initiated and user-controlled (push and pull)

Category Difficulties (work for lawyers)

- Regulated vs. unregulated services
  - "enhanced" services not subject to common carrier regulation under FCC rules
  - 1996 Telecom Act has similar distinction between "telecommunications" and "information" services
  - "Basic" vs. "value-added" services often used outside of U.S.
- Type of service
  - Telephony, broadcasting, cable, etc.
- Jurisdictional Divisions
  - local, state, national, international

Old Rules vs. New Realities

- Literal readings generate strange results
  - Is an email message telecommunications?
  - Is cable Internet access different from access provided by a telco?
- Some line drawing is inevitable, even if only to exclude the Internet from traditional rules
- The Internet overcomes all boundaries
  - No discrete connection paths
  - ISPs may not even know what services run over their networks
- Technology and businesses keep moving
  - For example, development of Internet telephony, and now phone-to-phone gateway services; streaming video
- Impossibility of tying down dynamic change

The Future?

- Bandwidth demand will keep growing
  - continued increase in Internet penetration
  - push media and streaming video
  - Internet games
  - electronic commerce
- Local competition will develop
- Continued experimentation with different business models will continue, as companies search for the "killer app" and a justification for their market cap
- Converged networks will emerge
  - voice just one service riding on packet-switched data networks

The Future?

- External simplicity, internal complexity
  - Many different technologies (wireline, cable, wireless, satellite) will succeed in different niches
  - However, consumers care only about the end user service, not how it is provided, and increased penetration will require simplicity
- Increased user choice and control over content

Coping with Dynamic Change

- Traditional legal and regulatory approaches become unworkable
  - So do traditional business models (telephone indusry growth averages 4-6% per year; Internet bandwidth requirements more than double every year)
- Pace of technological innovation continues to increase (especially as competition develops)
- Need to break from the past
  - "[T]he most important insight I've garnered from three years at the FCC: Study with scrupulous exactitude all telcom policies of historical tradition and then do the exact opposite." -- FCC Chairman Reed Hundt, September 4, 1996

Toward a Rational Approach

- Do not assume legacy regulation of new services
  - Presume public utility regulation model should not apply to competitive data services
- Identify easy cases for non-regulation
  - ISPs that are merely a conduit for voice applications employed by others
- Focus on underlying policy goals
- Simple, flexible rules
  - essential due to rapid technological change and slippery boundaries
- Consider deregulating traditional services if market truly competitive

Internet as Subsidy-Free Zone?

- FCC received over 300,000 email comments opposing imposition of access charges on ISPs
- This was a GREAT thing
  - Demonstrates that the industry cares and can mobilize on issues
- BUT.. never have so many said so little to so few!
  - The emails were attacking the FCC for something it explicitly proposed NOT to do.
  - Few constructive proposals for increasing availability of bandwidth (most just opposition to paying more)
- The real issue -- how to create efficient incentives for carriers to invest in data-friendly networks that don't route data traffic through circuit switches?

Chaos Isn't All That Bad

- Chaos theory:
  - Complex systems can self-organize
- Benefits of decentralization
  - great flexibility
  - allows dynamic growth and evolution
  - reduced need for (potentially cumbersome) central control structures
- Difficult or impossible for one firm to dominate
  - new, unexpected competitive alternatives
- With proper incentives, solutions will emerge to meet demand
- Chaos leads to opportunity for the nimble

For More Information

- FCC Web site <http://www.fcc.gov>